



**Technical Requirements**

for the

**Connection of Generation**

**Less Than or Equal to 100 kW**

that will

**Synchronize with the Ameren Electric System**

and

**No power sales will be involved**

**Reference Document – “A3129”**

AMEREN COMPANY  
PROTECTION REQUIREMENTS  
FOR  
PARALLEL OPERATION OF  
SMALL - SIZE GENERATING FACILITIES  
100 KILOWATTS AND LESS

I. INTRODUCTION

This document describes the minimum protective equipment which Ameren company (Ameren) requires for operation of its electric system in parallel with a generating source(s) with total facility output of 100 KW or less. These requirements have been established for the protection of life and property and are intended to assist the owner (s) of small-sized electric power generators (Applicant) in evaluating their electrical generating system requirements.

A. It is Applicant's responsibility to:

1. Design, install, operate, protect, and maintain all necessary equipment for connection to Ameren's electric system, unless otherwise stated in the contractual agreement.

The Customer is responsible for protecting Customer-owned equipment in such a manner that faults or other disturbances on the Ameren electric system or on Customer's system do not cause damage to his equipment.

2. Comply with all local, state, and federal rules, regulations and codes which are applicable; including, but not limited to, National Electrical Safety Code (NESC) and Article 705 of the National Electrical Code latest revision or the requirements of this document, if more restrictive.

Applicant's interconnecting transmission and/or distribution lines shall be designed, constructed and maintained in accordance with applicable National Electrical Safety Code standards except that in no case shall applicant utilize a standard less than adhered to by Ameren.

3. Submit specifications and detailed plans to Ameren for the installation of the control and protective devices for review and written approval prior to the purchase and installation of such equipment as hereinafter described and summarized in Appendix A.

B. Initial parallel operation will be permitted only after Ameren has:

1. Inspected the completed installation.
2. Received and reviewed certified test reports for protective device tests. The tests could be performed by Applicant or manufacturer. The test reports must show that the relay has been field tested by applying secondary currents and/or voltages at the proper frequencies. This will indicate if the relay will operate at the specified setting and within the tolerance give in the manufacturer's relay instruction bulletin. This work must also include tests for relay secondary circuits.

Ameren shall have the opportunity to witness all the above tests.

3. Received and approved control schematics and relay style numbers and settings associated with the Applicant's installation.

4. Given written approval as stated in the appropriate power purchase or paralleling agreement.
5. Given verbal approval through the designated Ameren facility immediately prior to paralleling with the Ameren's electric system. Ameren personnel shall perform phasing tests prior to granting this approval.

The above requirements are needed to determine that Applicant's equipment can be safely connected to Ameren's electric system. Ameren may disconnect the facility from Ameren's electric system at any time upon proper notification if it is found that the facility is unsafe or causes interference with Ameren's electric system or its customers.

## II. PROTECTIVE EQUIPMENT REQUIREMENTS

Minimum protection requirements are necessary for safe and reliable parallel operation of both the Applicant's equipment and Ameren's electric system. While most commercially available generators are equipped with some protective and control devices, additional equipment may be required to permit parallel operation with Ameren's electric system, depending on the location, type and size of the generator. See Figure 1, typical protection scheme.

All high voltage equipment used by Applicant shall be constructed in accordance with the latest applicable standards of the American National Standards Institute (ANSI) or the National Electrical Manufacturers Association (NEMA). All installations shall comply with article 705 of the National Electric Code latest revision or these requirements, whichever are more restrictive.

All Customer protective relays and/or devices must have approved built-in test provisions. These provisions should allow complete testing of the relays and/or devices by injecting test currents or voltages into the devices without lifting wires to the devices or disconnecting any control circuit wiring.

### A. All generator installations must have:

#### 1. Disconnecting devices:

Disconnecting devices must be provided as a means of electrically isolating the Applicant's generation from Ameren's electric system. A disconnecting device must be located between each generator and the Applicant's main distribution bus. In addition, a disconnecting device is also required between the Applicant's distribution bus and Ameren's electric system as required by normal service policies.

The disconnecting devices will be furnished and installed by Applicant as part of Applicant's wiring, and is subject to the following requirements:

- a. Only devices specifically approved by Ameren for this purpose may be used. The device must provide a visible means of disconnection and be capable of being locked open with Ameren's padlocks.
- b. The device shall be located for ease of access and visibility.
- c. Ameren personnel shall inspect and approve the installation before initial parallel operation will be permitted.
- d. Applicant is responsible for all labor and material costs to maintain, repair, or replace the disconnecting device.

2. Circuit breaker or contactor:

A circuit breaker allows Applicant's generation equipment to be separated automatically from Ameren's electric system. This breaker must have sufficient interrupting capacity to interrupt maximum available fault current at its location, and be equipped with accessories to trip the breaker with an external trip signal (shunt trip).

As an alternative, a contactor with overcurrent sensing devices on each phase and undervoltage release may be used provided that a series trip circuit breaker be incorporated so that the contactor /circuit breaker combination has sufficient interrupting capacity to interrupt maximum available fault current at its location.

3. "Loss of Ameren's electric system" scheme:

This scheme detects the loss of the interconnection between Applicant's generator and Ameren's electric system. Upon loss of this interconnection, a circuit breaker or contactor located between Applicant's generator and Ameren's electric system must trip to prevent Ameren from automatically reclosing out of synchronism. The devices necessary to accomplish this goal will vary depending on the configuration of the interconnection. The sensitivity and operating speed of these devices must be compatible with protective devices on the Ameren's electric system. The above criteria may be met by some combination of the following:

a. Over-and under-voltage relays:

These relays are used to trip the circuit breaker when the voltage is within the relay settings.

- i. The overvoltage relay is set to initiate at trip of the circuit breaker with a two-second time delay when the voltage is equal to or above 110 percent of normal.
- ii. The undervoltage relay is set to initiate a trip of the circuit breaker with a two-second time delay when the voltage is equal to or below 90 percent of normal.

b. Over-and under-frequency systems:

Over-and under-frequency relays are used to trip the circuit breaker when the frequency varies from the nominal of 60 Hz.

- i. The overfrequency relay shall be set to trip the generator off line within 0.5 seconds when the frequency reaches 63.0 Hz.
- ii. The underfrequency relay shall be set to trip the generator off line within 0.5 seconds when the frequency drops to 58.3 Hz.

Frequency protection is not required for generators connected to Ameren's system through a solid state inverter which is line-commutated or for induction generators due to their inherent operating characteristics.

c. A reverse power relay:

This relay will detect the flow of power into Ameren's electric system and trip the generator off line. This scheme can only be used if the generating facility was originally designed not to provide excess generation to Ameren.

4. A dedicated transformer which serves only the Applicant is required for installations above 10 KW.

The dedicated transformer provides isolation between the Applicant's generator Ameren's electric system. The Applicant will be charged for all additional facilities deemed necessary (including the dedicated transformer, if provided only for isolation).

5. Overcurrent devices:

These relays will sense system faults and trip Applicant's main and/or generator breaker, thus prohibiting Applicant's generator from continuously contributing to a phase-to-phase or phase-to-ground fault on Ameren's electric system.

- a. If the overcurrent devices cannot be set with adequate sensitivity, directional overcurrent relays may be required.
  - b. If the overcurrent devices cannot detect ground faults on the Ameren side of the transformer, a ground detector relay scheme may be required. This scheme requires three phase potential on the Ameren side of the transformer and an overvoltage relay.
- B. It is Applicant's responsibility to remove the generator from the system and re-synchronize before reclosing its breaker. Ameren does not provide synchro-check or automatic synchronizing equipment for its remote breakers. After a relay operation, Ameren will reclose automatically through no interlocks.
- C. Synchronous generators and induction generators designed to operate similar to synchronous generators must also have equipment necessary to manually synchronize with Ameren's electric system.
- D. The Customer is responsible for protecting Customer-owned equipment in such a manner that faults or other disturbances on the Ameren electric system or on Customer's system do not cause damage to his equipment.

Ameren recommends that Applicant:

1. Protect his three-phase equipment from negative sequence currents.

Certain conditions in the electric system may cause negative sequence currents to flow. It is the sole responsibility of Applicant to protect his equipment from excessive negative sequence currents.

2. Perform the following tests:

- a. Phase-to-phase and phase-to-ground insulation integrity tests. Insulation integrity tests should be performed on Applicant's side of the open disconnect switch to the service point, including high voltage cable runs with all of Applicant's primary breakers and fuses racked open.
- b. Individual insulation integrity. These tests should be performed on all major equipment such as primary breakers, potential transformers, and station service and auxiliary transformers.

E. Protective Equipment Information:

The information listed in Appendix A is to be submitted by the Applicant in a timely manner. This information is required for Ameren to evaluate the system protection and equipment ratings.

### III. OPERATION

Under certain conditions the inter-tie breaker (if one is required) must be operated by Customer in order for Ameren to operate the manual disconnect switch. Ameren may request this action for any of the following reasons:

- A. System emergency.
- B. Inspection of Customer's generating equipment or protective equipment reveals an unsafe condition.
- C. Customer's generating equipment interferes with other customers or with the operation of the Ameren electric system.
- D. An outage is scheduled on the Ameren supply circuit or feeder.

### IV. QUALITY OF SERVICE

The interconnection of Customer's generating equipment with the Ameren electric system shall not cause any reduction in the quality of service being provided to other customers or cause any undesirable effect on any Ameren facilities. Such interconnection shall be pursuant to the latest revision of IEEE-519, IEEE-1547, and the latest ANSI Standards C50.10 and C50.13 dealing with wave form and telephone interference.

The power factor of Customer's load with his generating equipment connected shall not be less than that specified by retail tariff for his applicable customer class.

### V. METERING

Parallel generating facilities connected to Ameren's electric system are divided into two groups: (1) "Two-way Power Flow," and (2) "One-way Power Flow." "Two-way Power Flow" would apply to Customer's facilities whose load is sufficiently variable or smaller than its generating capacity so that excess Customer-generated power could flow into the Ameren electric system. "One-way Power Flow" would apply to Customer's facilities whose load is significantly larger than their generating capacity so that no Customer-generated power would flow into the Ameren electric system except under fault conditions.

#### A. Two-way Power Flow

This type of installation provides for the interchange of energy in either direction as a normal operating mode.

The revenue metering for Two-way Power Flow installations shall include two series connected watthour meters with detents. One meter shall be connected to measure energy supply to Customer from Ameren; the other meter shall measure Customer-generated energy supplied to Ameren. The meter detents prevent operation of either meter in the reverse direction.

Additional metering may or may not be required depending on the terms of the contract between Ameren and Customer.

## B. One-way Power Flow

This type of installation does not allow the interchange of energy from Customer to the utility.

The inter-tie circuit breaker will be tripped by equipment capable of detecting the reverse power flow condition toward the Ameren electric system.

This type installation requires a single revenue meter installation with detent to prevent operation of the meter in the reverse direction.

Additional metering may or may not be required depending on the terms of a contract between Ameren and Customer.

## VI. OTHER REQUIREMENTS:

- A. All Customer installations shall adhere to any applicable requirements of the National Electrical Safety Code, the National Electric Code, applicable NEMA codes, OSHA, and Ameren's Electric Service Rules as set forth in published tariffs.
- B. Customer will bear all interconnection costs of parallel operation over and above the normal cost to serve his load.

## VII. MISCELLANEOUS

### A. Liability:

Ameren shall not be liable for any costs or damage incurred by Applicant or by any individual or entity in conjunction with Applicant's project as a result of complying with the requirements contained herein above.

### B. Approval by Ameren:

Ameren shall make every reasonable effort to provide Applicant with necessary information and approvals in a timely manner. Ameren shall not be responsible for any costs or damages incurred by Applicant or others as result of Ameren's review and approval process of Applicant's project.

### C. Wavier of requirements:

To request a waiver or variance from meeting any of the above requirements, Applicant shall make a written request to Ameren containing the following information:

1. Requirement to be waived.
2. Reasons for waiver.
3. Other information necessary to support Applicant's position, such as drawings, technical data, cost information, etc...

Ameren shall have at least 30 days to consider the granting of any such waivers. Ameren shall notify Applicant in writing of its decision.

VIII. SUMMARY

EQUIPMENT REQUIREMENTS AND RECOMMENDATIONS

ITEM	MACHINE SIZE 100 KW & LESS
<u>All Generators</u>	
Disconnecting Device	Required
Circuit Breaker or Contactor-Circuit Breaker Combination	Required
“Loss of Ameren's electric system” scheme	Required
Over / Undervoltage Protection	Maybe
Over / Underfrequency Protection	Maybe
Reverse Power Relay	Maybe
Dedicated Transformer	Required (Over 10kW)
Overcurrent Devices	Required
Directions Overcurrent Protection	Maybe
Ground Detector Relay	Maybe
Synchronizing Equipment	Required (Synchronous Generators)



APPENDIX A

TECHNICAL INFORMATION REQUIRED TO BE SUBMITTED TO AMEREN  
For  
GENERATING FACILITIES 100 KILOWATTS AND LESS

The following must be furnished to Ameren by the applicant or his representatives:

Customer's Name: \_\_\_\_\_

Contact Person: \_\_\_\_\_

Location: \_\_\_\_\_

Telephone of contact person: \_\_\_\_\_

Service Point Location: \_\_\_\_\_

Generator: (Complete all applicable items)

Manufacturer: \_\_\_\_\_

Type: \_\_\_\_\_

Kilowatt Rating: \_\_\_\_\_

Kilovolt-ampere Rating: \_\_\_\_\_

Power Factor: \_\_\_\_\_

Output Voltage: \_\_\_\_\_

Output Amperes: \_\_\_\_\_

Phase and Frequency: \_\_\_\_\_

R.P.M. \_\_\_\_\_

Field Amps: \_\_\_\_\_

Field Volts: \_\_\_\_\_

Year Installed: \_\_\_\_\_

Serial Number: \_\_\_\_\_

Prime Mover: \_\_\_\_\_

Manufacturer: \_\_\_\_\_

Type: \_\_\_\_\_

Energy Source: Briefly describe the cogeneration, wind solar,  
hydro or other energy source: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Protective and Control Devices:

Disconnecting Device - Manufacturer and Type: \_\_\_\_\_

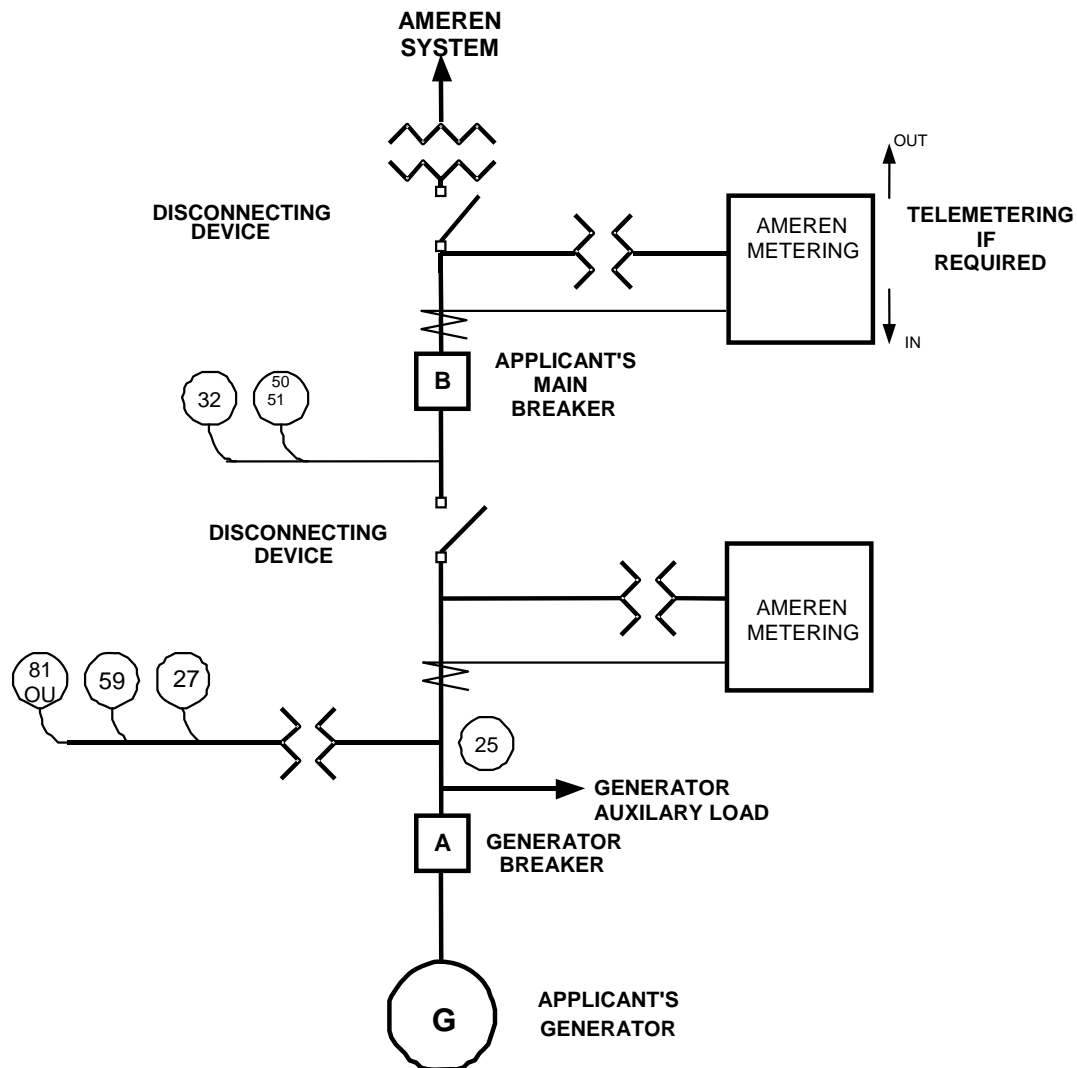
Circuit Breaker - Manufacturer and Type: \_\_\_\_\_  
\_\_\_\_\_

Loss of Ameren's electric system scheme,  
Describe: \_\_\_\_\_  
\_\_\_\_\_

Capacitors Type and Size: \_\_\_\_\_  
\_\_\_\_\_

A single line diagram of the installation shall accompany this information.

TYPICAL  
PROTECTION AND METERING INSTALLATION  
FOR GENERATORS 100KW AND LESS



GENERATOR AND SYSTEM PROTECTION		
DEVICE NO.	FUNCTION	TRIPS BREAKER
25	SYNCHRONIZING	-
27	UNDERVOLTAGE	A or B
32	REVERSE POWER	A or B
*50/51	OVERCURRENT	B
59	OVERVOLTAGE	A or B
81OU	OVER & UNDER FREQUENCY	A or B

\*May have to be replaced with directional O.C. relays and/or a ground detector scheme

**FIGURE 1**

**Attachment A**

**One Line diagram  
of  
Customer's Generation**

## **Attachment B**

### **Site Map**

## **Attachment C**

### **Waivers**

None